Oilseed Production for Biodiesel in Montana

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What is biodiesel?

- Biodiesel is a fatty acid ester, produced through transesterfication process:

Oil (fatty acid) + Alcohol (methanol or ethanol) + NaOH or KOH → Glycerol & Biodiesel

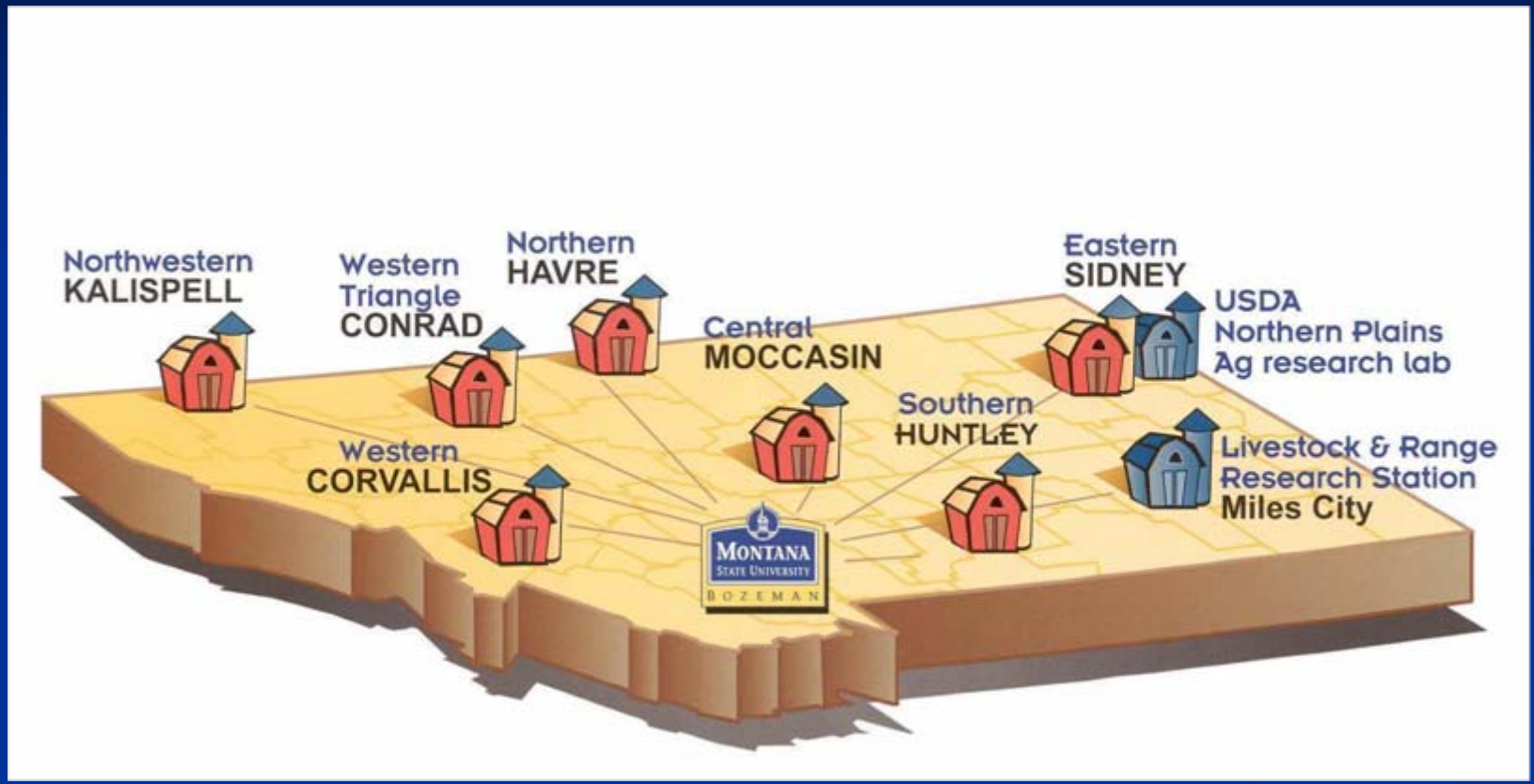
99% efficiency (one gal. oil ~ one gal. biodiesel)

Feedstock costs 75%, reducing production cost for oil feedstock is crucial.

2005 Oilseed Crops Production in Montana

Crop	Acres	Yield (lb/ac)	Oil (%)	Oil (lb/ac)
Flaxseed	54000	1020	34-40	
Safflower	29000	890	36-44	
Canola	16500	1290	38-44	
Mustard	10800	580	32-35	
Sunflower	6400	1150	44-50	
Camelina			30-44	
Soybean			18-20	

Montana Agricultural Experiment Station
Research Centers



Reaching Out Across the State

Central
www.ag.montana.edu/carc/
406-423-5421

Eastern
www.sidney.ars.usda.gov/state/
406-433-2208

Northern
www.ag.montana.edu/narc/
406-265-6115

Northwestern
www.ag.montana.edu/nwarc/
406-755-4303

Southern
www.sarc.montana.edu/
406-348-3400

Western
www.ag.montana.edu/warc/
406-961-3025

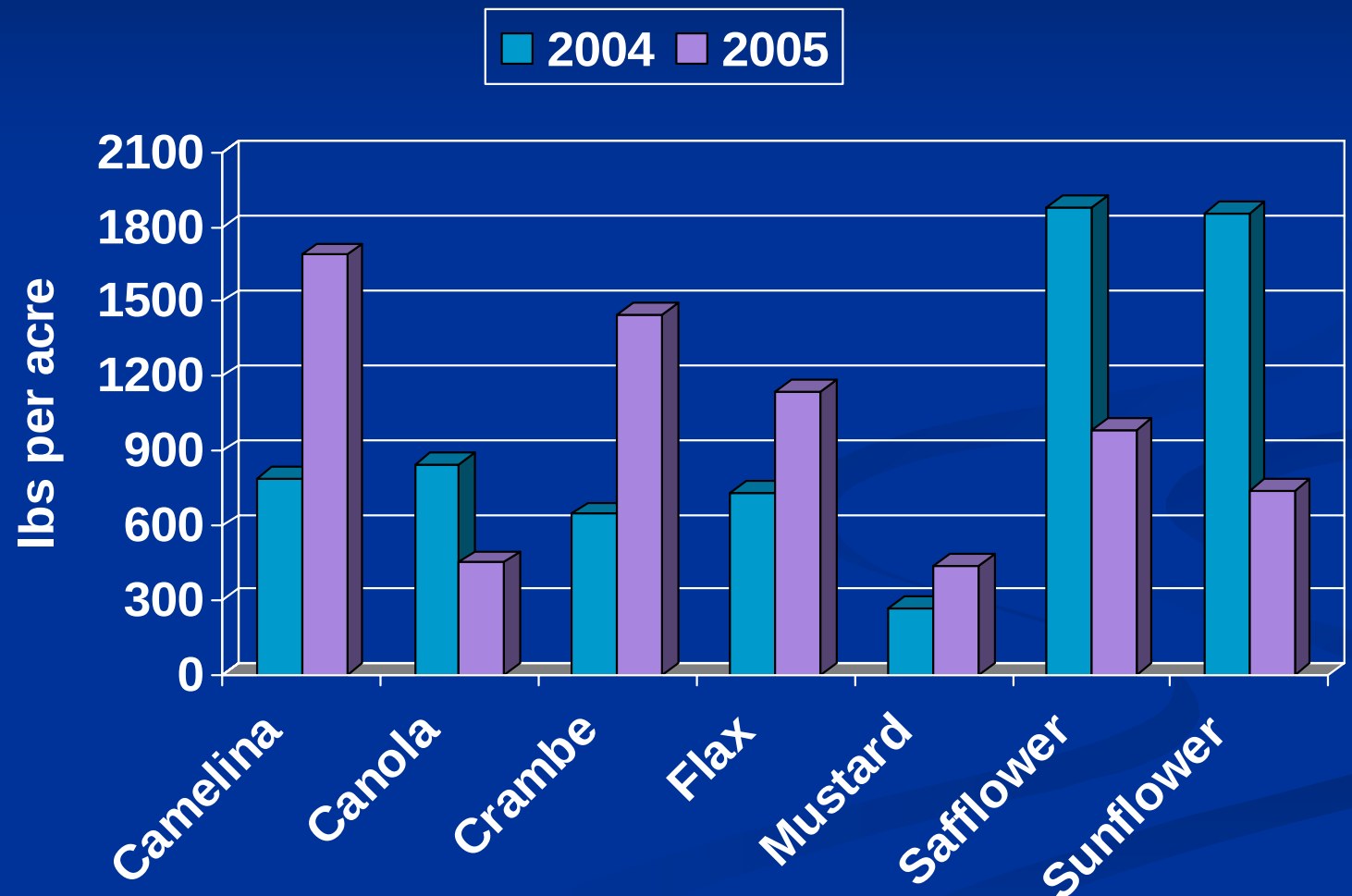
Western Triangle
www.ag.montana.edu/wtarc/
406-278-7707

MAES HQ in Bozeman
www.montana.edu.agriculture/
406-994-3681

Multi-Species Oilseed Evaluation

Peggy Lamb, NARC, 2004

Multispecies Oilseed Grain Yield at Havre (from Peggy Lamb, NARC)



Sunflower

- Warm season crop
- Long growing season
- Deep rooting and high water user
- Bird damage
- Low test weight
- Herbicide: trifluralin
- Oil content: 44-50%

Safflower

- Warm season crop
- Long growing season
- Deep rooting and high water user
- Herbicide: trifluralin
- Oil content: 36-44%
- Contact: Jerald Bergman, EARC, 406-433-2206

Soybean

- Warm season crop
- Long growing season
- Early maturing variety available
- Oil content: 18-20%
- Irrigation: ?
- Herbicide: yes
- Contact: Ken Kephart, SARC, 406-348-3400.

SoyBase Soybean Picture Gallery
http://soybase.agron.iastate.edu/resources/SoyWebPics/mainpage.html

Flaxseed

- Brown and yellow classes
  - Food and Fiber
- Widely adapted crop grown in Montana since sod was first broken
- Production methods similar to spring wheat
- Market – commodity and potential niche
- Oil content: 34-40%
- Herbicides: yes
- Never go into bin –drowning potential
- Contact: Dave Wichman, CARC, 406-423-5421

From Wikipedia, the free encyclopedia

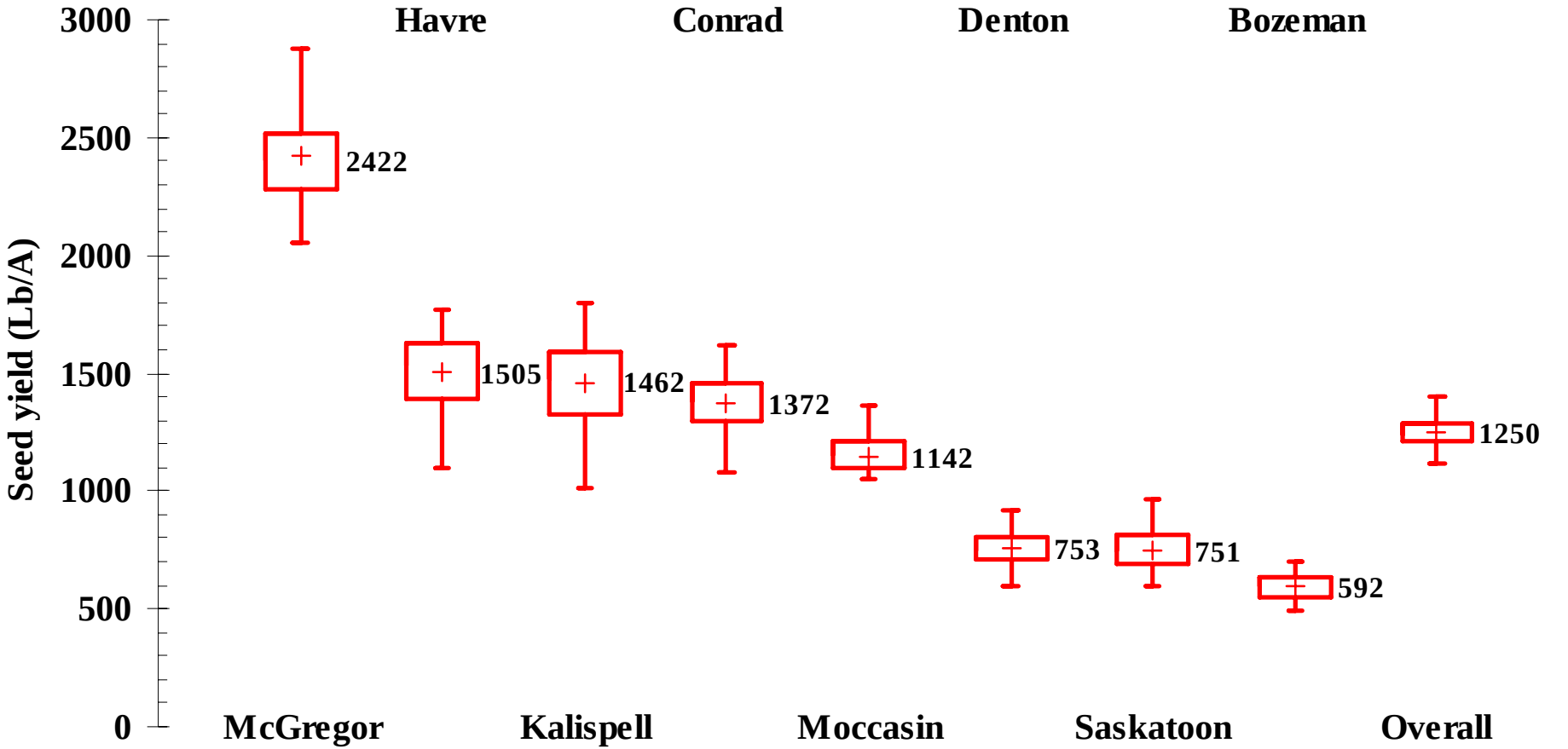
Camelina

- Originates in Europe
- New to Montana, adapted to dryer area
- Breeding effort is underway
- Winter annual
  - Facultative nature
- Small seed
- Susceptible to shatter
- Oil content : 30-44%
- Herbicide: None
- Market: Great Northern Growers, contact Gary Iverson, 406-937-4000
- More info: contact Duane Johnson, NWARC, 406-755-4303

Camelina at Vegetative Growth Stage (from Peggy Lamb, NARC)

Camelina Before Maturity (from Peggy Lamb, NARC)

Statewide Camelina Seed Yields



Source: Fernando Guillen-Portal, WestBred, LLC, 2006

Mustard

- Adapted to dryer area
- Resistant to insects and diseases
- Oil content: 32-35%

  Oil quality is lower than canola
- Small seed
- Shattering
- Herbicide: yes
- Different from *B. Juncea* (brown Mustard)

Canola and Rapeseed (*B. Juncea and B. napus*)

Canola or Rapeseed?

- Rapeseed (*Brassica napus*)
  - Canola: edible, low erucic acid (<2%), low glucosinolates (<30 mmol)
  - Industrial rapeseed: >45% erucic acid, high glucosinolates

Oil Profile

- Oleic (18:0): higher oleic content, higher heat tolerance.
- Linoleic (18:2): vitamin F.
- Linolenic (18:3): oxidation during storage
- Erusic: ability to withstand high temperatures and remain liquid at low temperature, but not edible.
- Glucosinolate: reduce palatability, iodine uptake.

Oil profile of different oilseeds

Name		Flax (%)	Sunflower (%)	Safflower (%)	Camelina (%)
Oleic	18:0	20	68*	75*	15.9
Linoleic	18:2	15	20	14	19.1
Linolenic	18:3	55	<1	<1	35.0
Erusic	22:1				0.1

Industrial and Edible Rapeseed

Name	Symbol	Industrial (%)	Edible (%)
Palmitic	16:0	4	9
Oleic	18:0	11	60
Linoleic	18:2	14	19
Linolenic	18:3	8	10
Eicosenoic	20:1	10	0.2
Erusic	22:1	52	0.3

Advantage of Canola Oil for Biodiesel

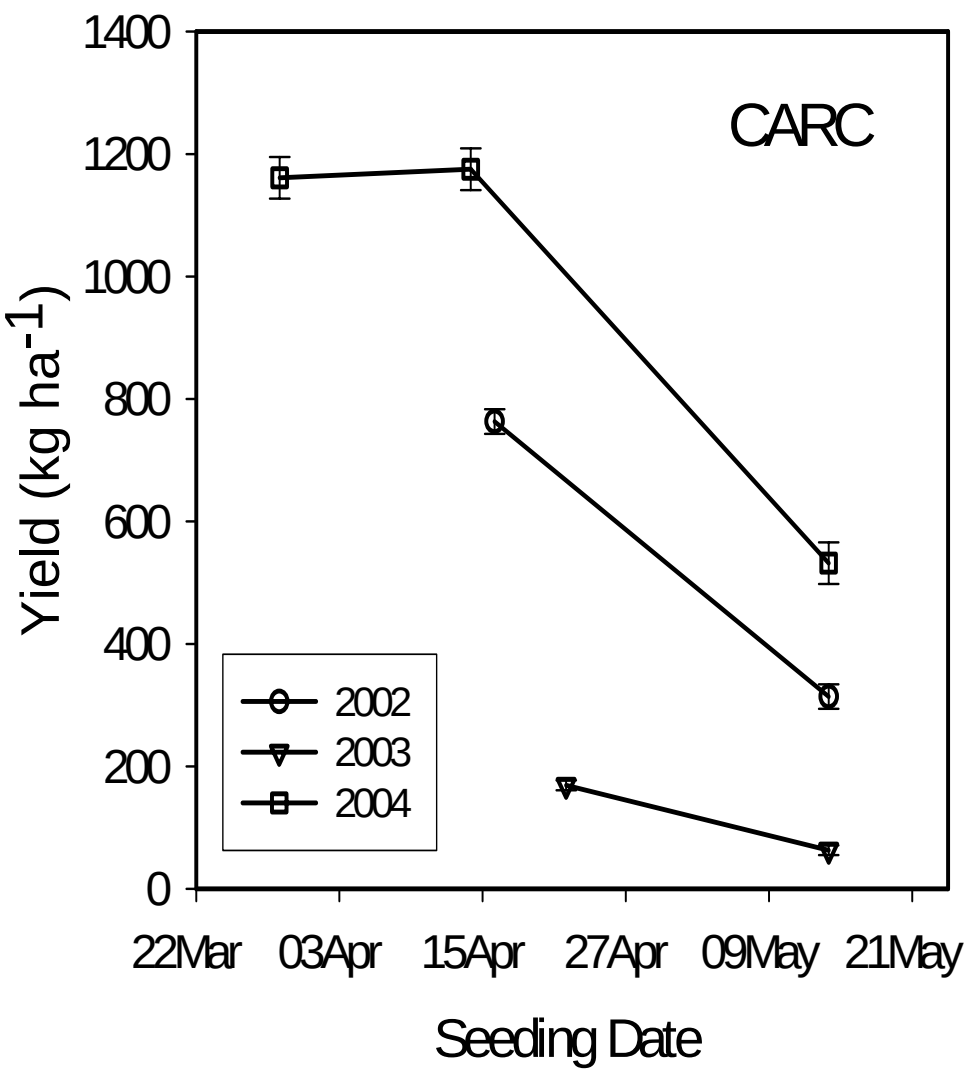
- Low saturated oil
- Lower pour and melting point
- Better cold flow properties
- High oil yield per acre
- High protein content (35-40%) in the meal
- Glucosinolates

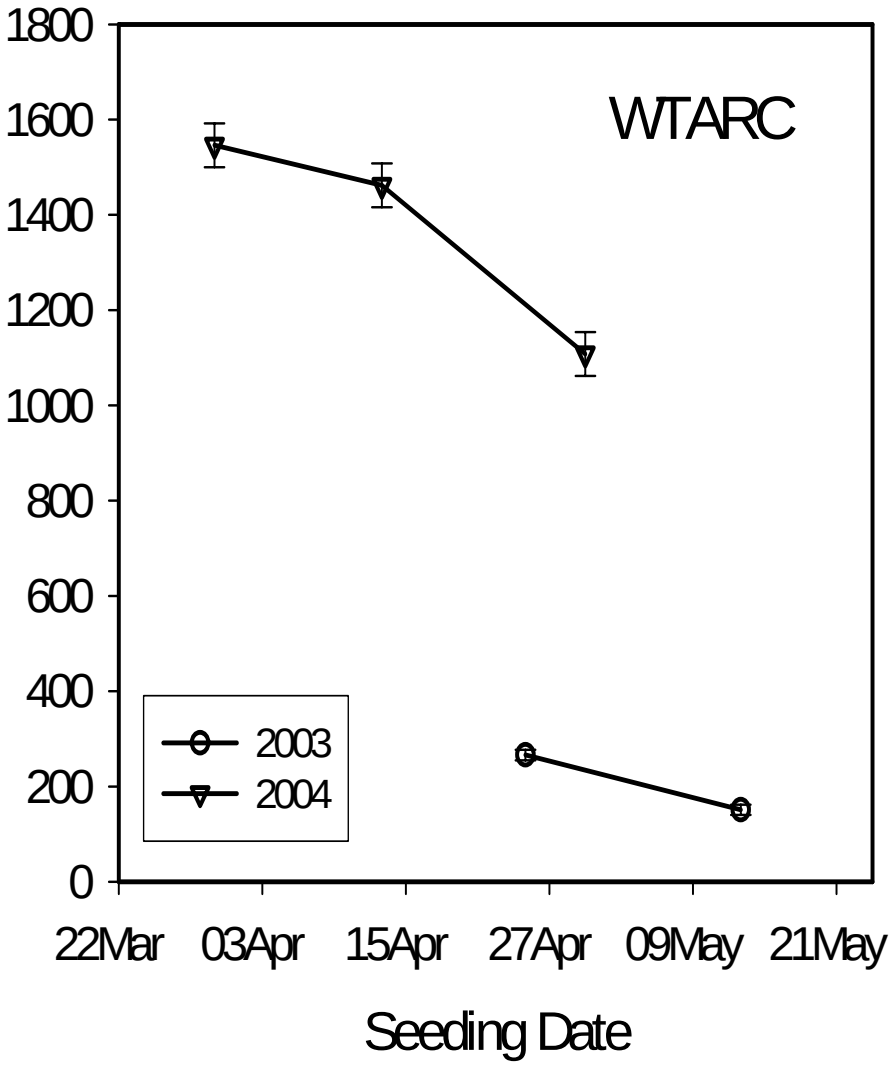
Agronomic Practices for Rapeseed

- Cool season crop, grow in cooler environments and higher elevations
- Good rotation crop to cereals
- Machinery similar to cereals
- Herbicide: yes
  Sensitive to SU (sulfonylurea) herbicides
- Spring and winter types

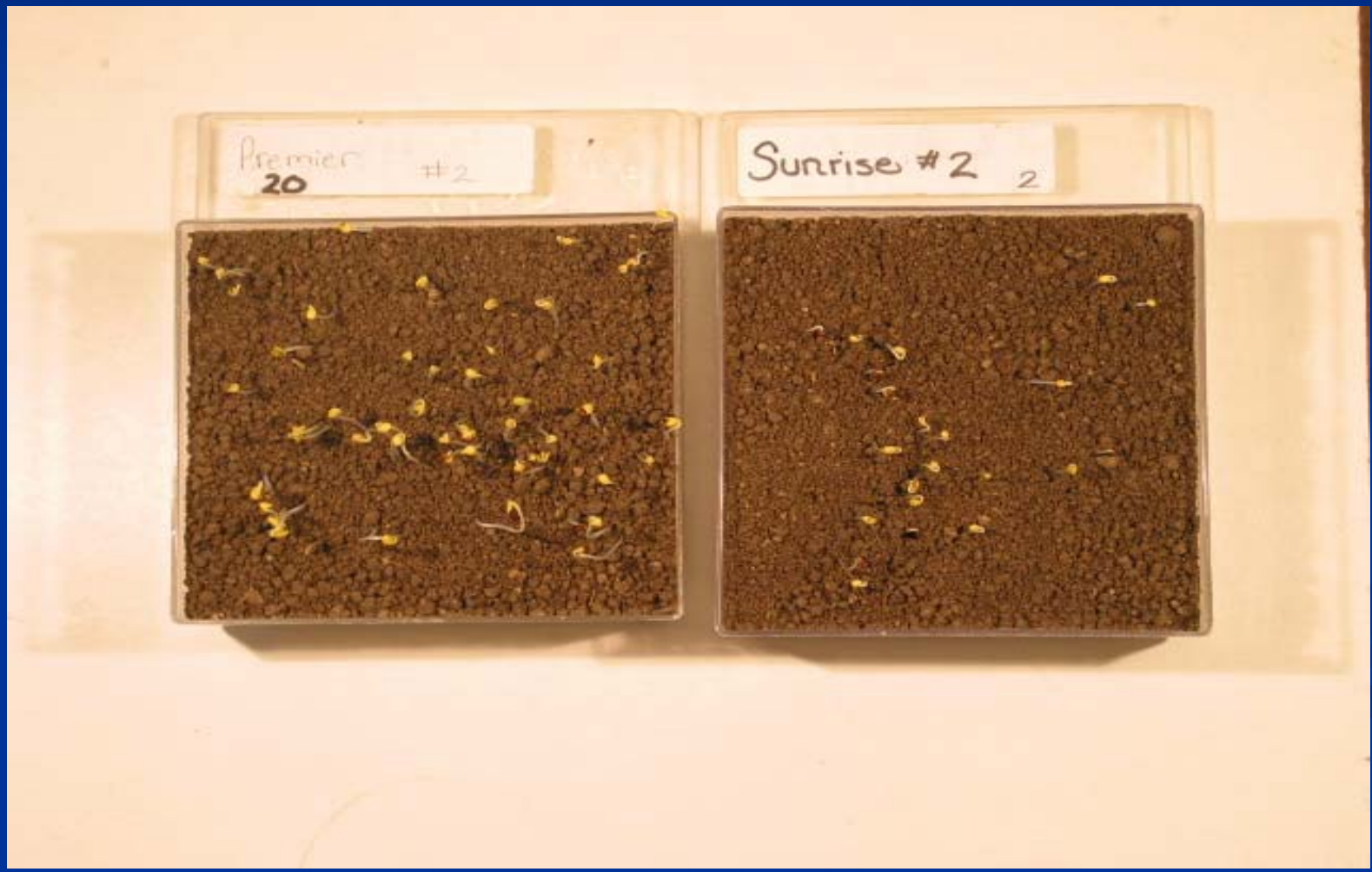
Seeding date is important

Effects of Seeding Date and Yield





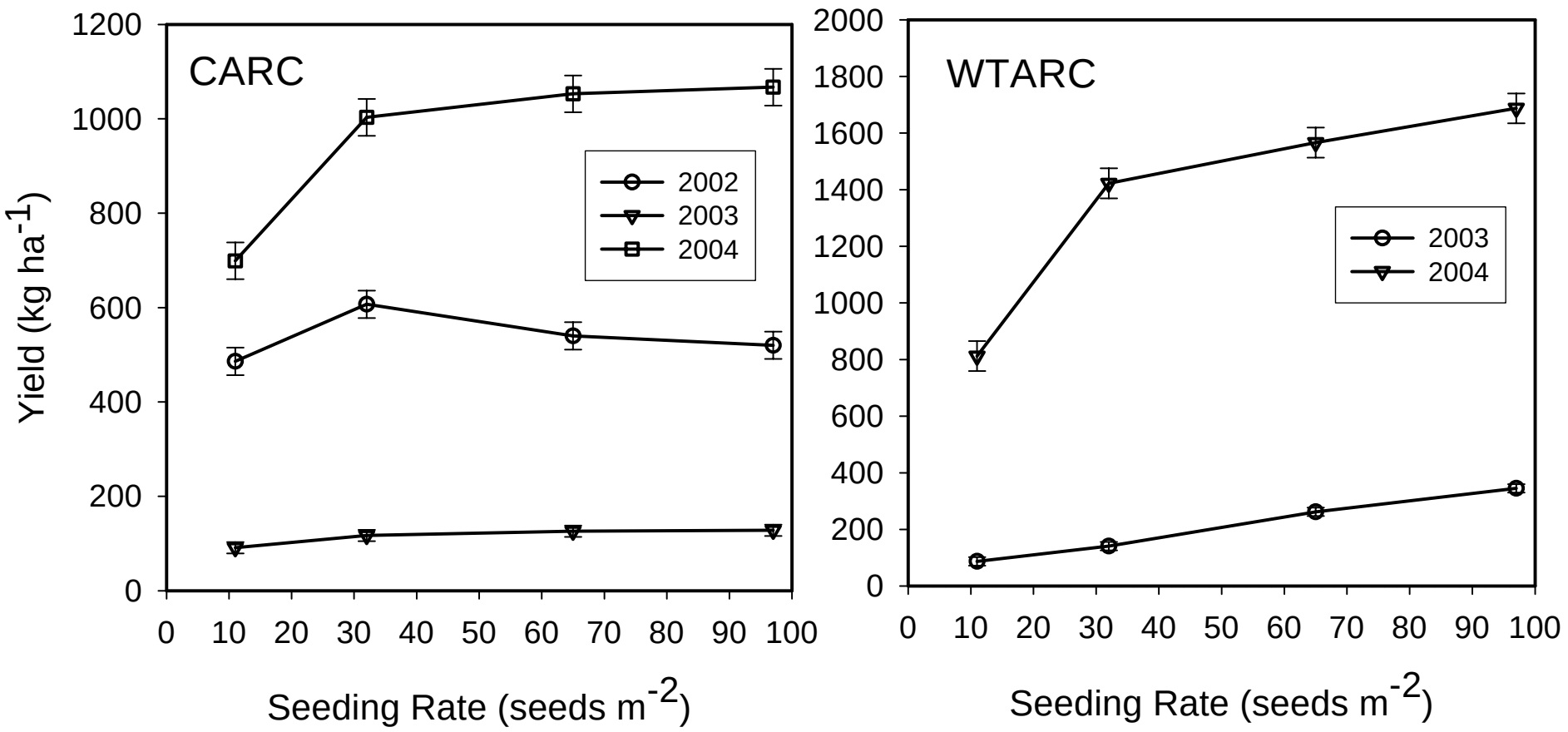
Canola can emerge in cold temperature (40oF)



Potential freezing damage on early seeded canola seedlings

Seedling recovery from cold stress

Seeding Rate



2.5 to 4.5 lb/a (0.26 – 0.52 g/100seeds)

Seeding depth, fertilizer, and herbicide

- Seeding depth: 0.5 in.
- Fertilizer: 78 lbs N/a for 1200 lbs/a yield
  104 lbs N/a for 1600 lbs/a yield
  20 lbs P_2O_5/a, 20 lbs S/a
- Herbicide: Treflan and Sonalan for preplant,
  Assure II for post emergence
  Roundup for Round-Ready canola
  Beyond for Clearfield-Ready canola

Pest management

- Insect: leaf flea beetle, grasshopper
- Disease: Blackleg, Fusarium, Rhizoctonia, Sclerotinia
  - Seed treatment: Helix XTra

Flea Beetle Damage

Grasshopper damage

Harvesting

- Direct combine
- Swathing and combine
- Pushdown prior to combine.

Direct Combine

Shattering

Hail Damage

Variety Selection

- DK223
- Hyola357
- Oscar
- Varieties from University of Idaho
- Industrial vs. edible rapeseed

Yield and Oil Content at CARC and WTARC

Cultivar	CARC		WTARC	
	Yield (lb/a)	Oil (%)	Yield (lb/a)	Oil (%)
Hyola 357	1107	38.4	2063	44.3
95SH2511017	875	41.6	1964	46.0
96SI510312	946	40.3	2214	43.5
Clearwater	884	40.3	1991	44.5
DKL223	1045	38.3	2295	43.3
DKL3455	786	41.7	2107	45.4
Garnet	938	41.3	1839	45.3
Impact	1054	41.9	1857	44.8
Premier	991	37.8	1938	44.1
Sterling	964	40.5	1955	44.9
Sunrise	964	40.0	1643	44.4
UISC00135	1205	37.7	2330	42.8
UISC00317	1134	39.4	1929	45.9
UISC0038DE	1152	39.0	1607	43.7
UISC02314	1071	42.5	1857	45.2
UISCH0031923	1107	40.7	2071	44.7
UISH003197	973	40.3	2223	45.1


Questions?